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Tsai

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(54) **AIR PUMP WITH INTERNAL AUTOMATIC CONTROLLER**

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F04B 35/06	(2006.01)
F04D 27/00	(2006.01)
F04D 17/12	(2006.01)
F04D 25/06	(2006.01)
F04D 29/42	(2006.01)
F04B 35/04	(2006.01)
F04B 49/02	(2006.01)
F04D 17/16	(2006.01)

(52) **U.S. Cl.**

CPC ***F04D 25/16*** (2013.01); ***F04B 35/04*** (2013.01); ***F04B 35/06*** (2013.01); ***F04B 49/02*** (2013.01); ***F04D 17/12*** (2013.01); ***F04D 17/16*** (2013.01); ***F04D 25/06*** (2013.01); ***F04D 27/007*** (2013.01); ***F04D 29/4206*** (2013.01)

(58) **Field of Classification Search**

CPC F04D 25/06; F04D 25/08; F04D 27/008; F04D 15/02; F04D 25/16; F04D 17/16; F04D 29/4206; F04D 27/007; F04D 17/12; A47C 27/082; A47C 27/083; F04B 49/002; F04B 35/04; F04B 35/06; F04B 49/02; H01H 13/568; H01H 35/245; H01H 27/00; H01H 13/562; H01H 35/2614

See application file for complete search history.

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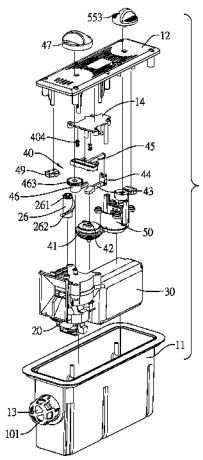
(57) **ABSTRACT**

An air pump with internal automatic controller has a housing, and a low-pressure blower, a high-pressure blower, a first auto-stop controller and a second auto-stop controller mounted in the housing. The first auto-stop controller has a first casing, a first air pressure sensing film, a pushing element, a swing rod, a connecting rod, a rotation restricting element, a first micro switch, a rotational pressing rod, and a first turning button. With the low-pressure blower inflating an inflatable article with low pressure air, and with the first auto-stop controller stably and reliably controlling the low-pressure blower, the low-pressure blower stops working automatically. The first auto-stop controller has simplified structure and inflates the inflatable article without manual work, which is a great convenience to users.

8 Claims, 20 Drawing Sheets



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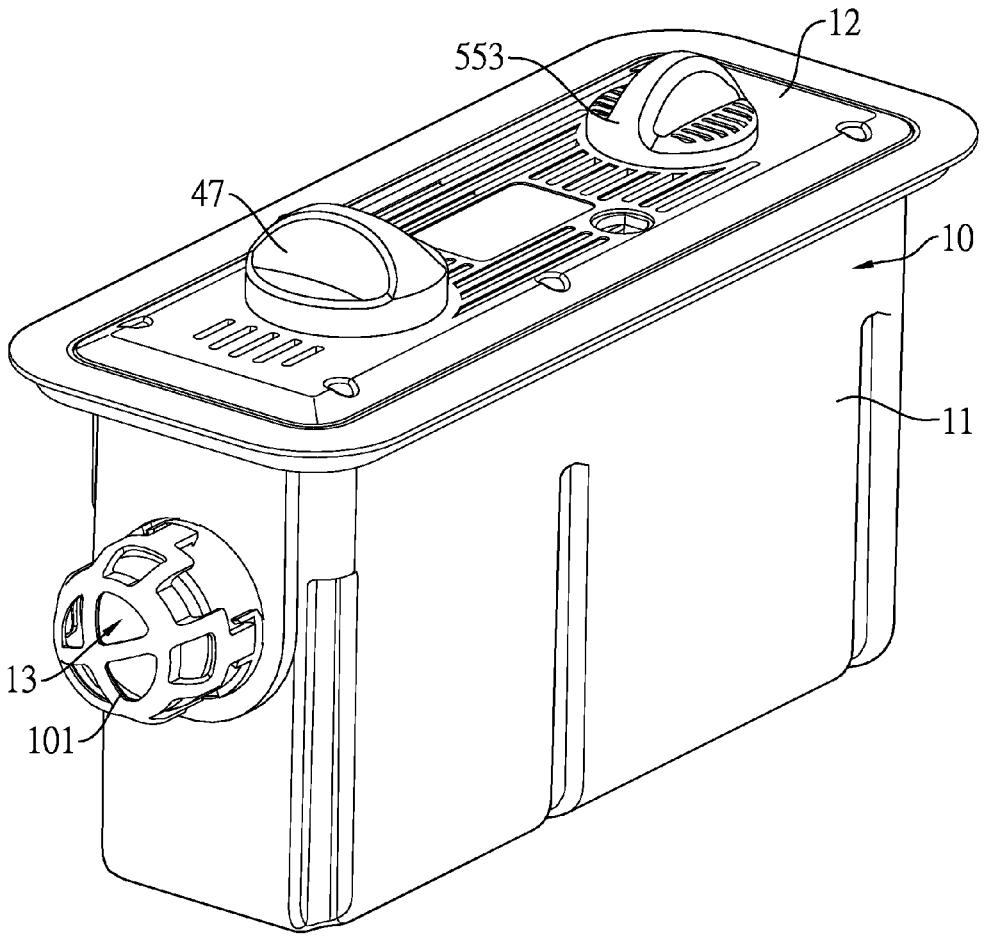

FIG. 1

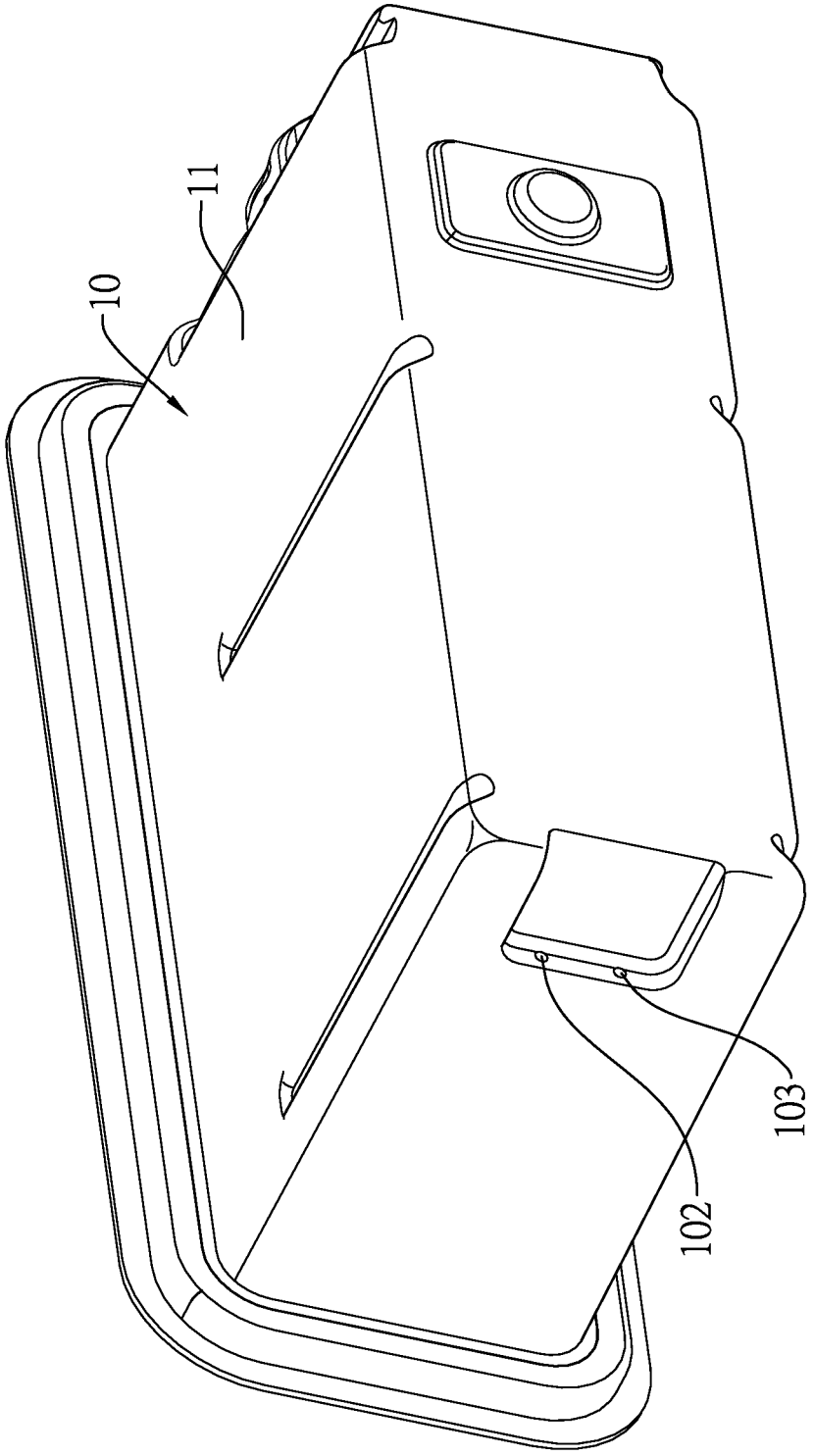

FIG. 2

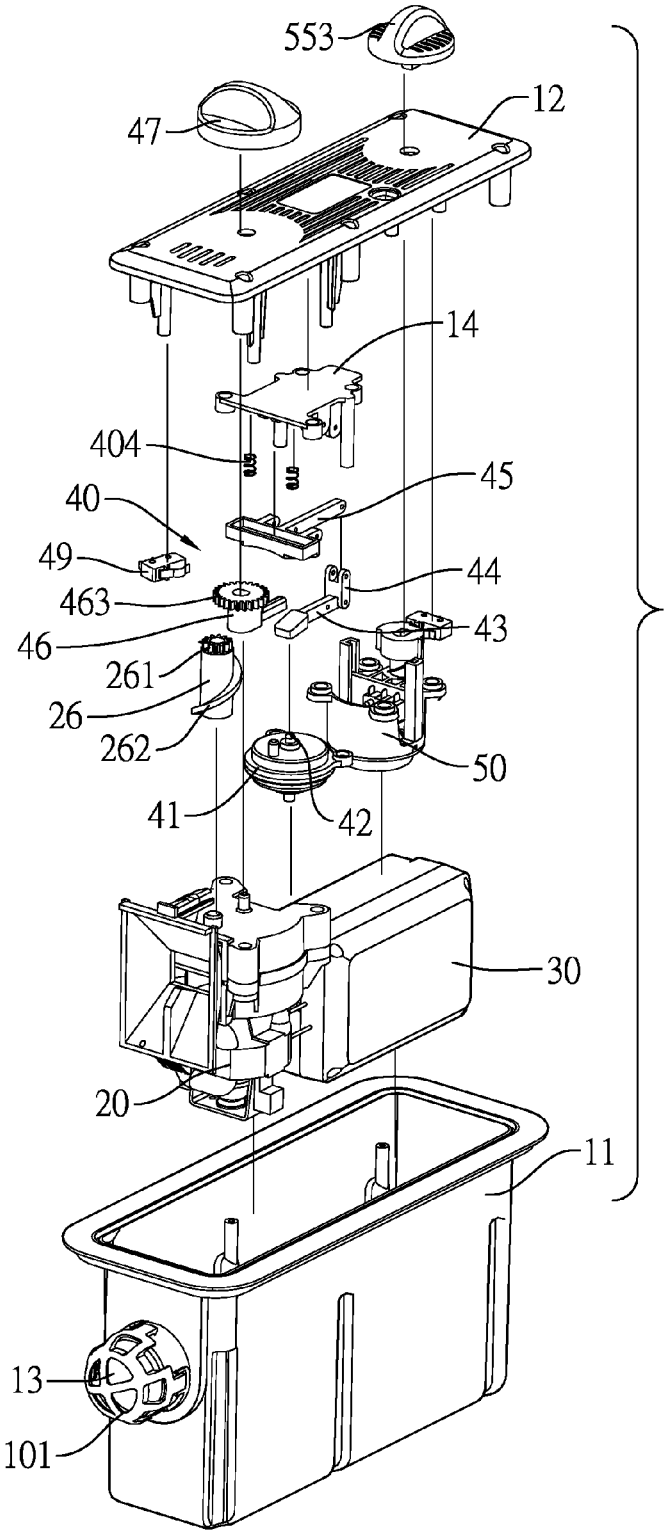
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FIG. 3

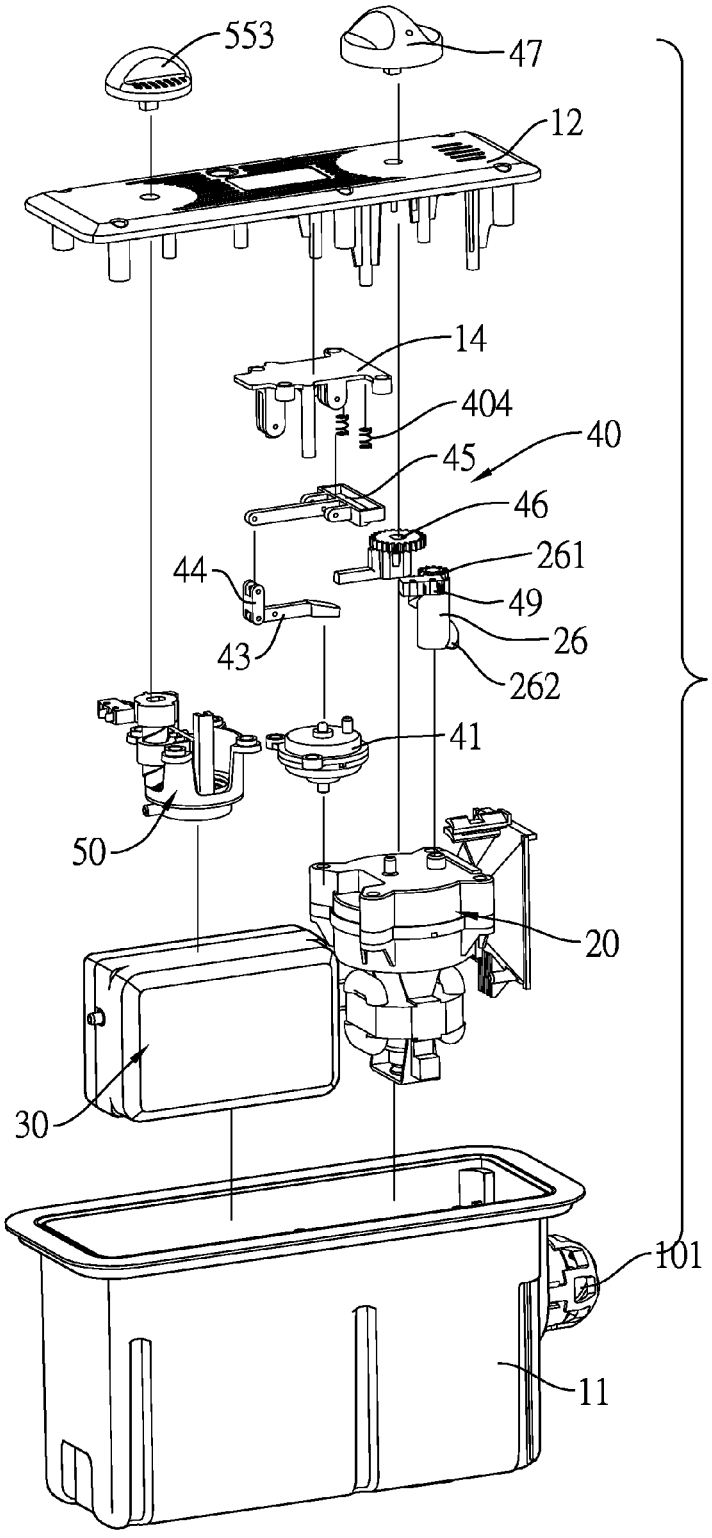

FIG. 4

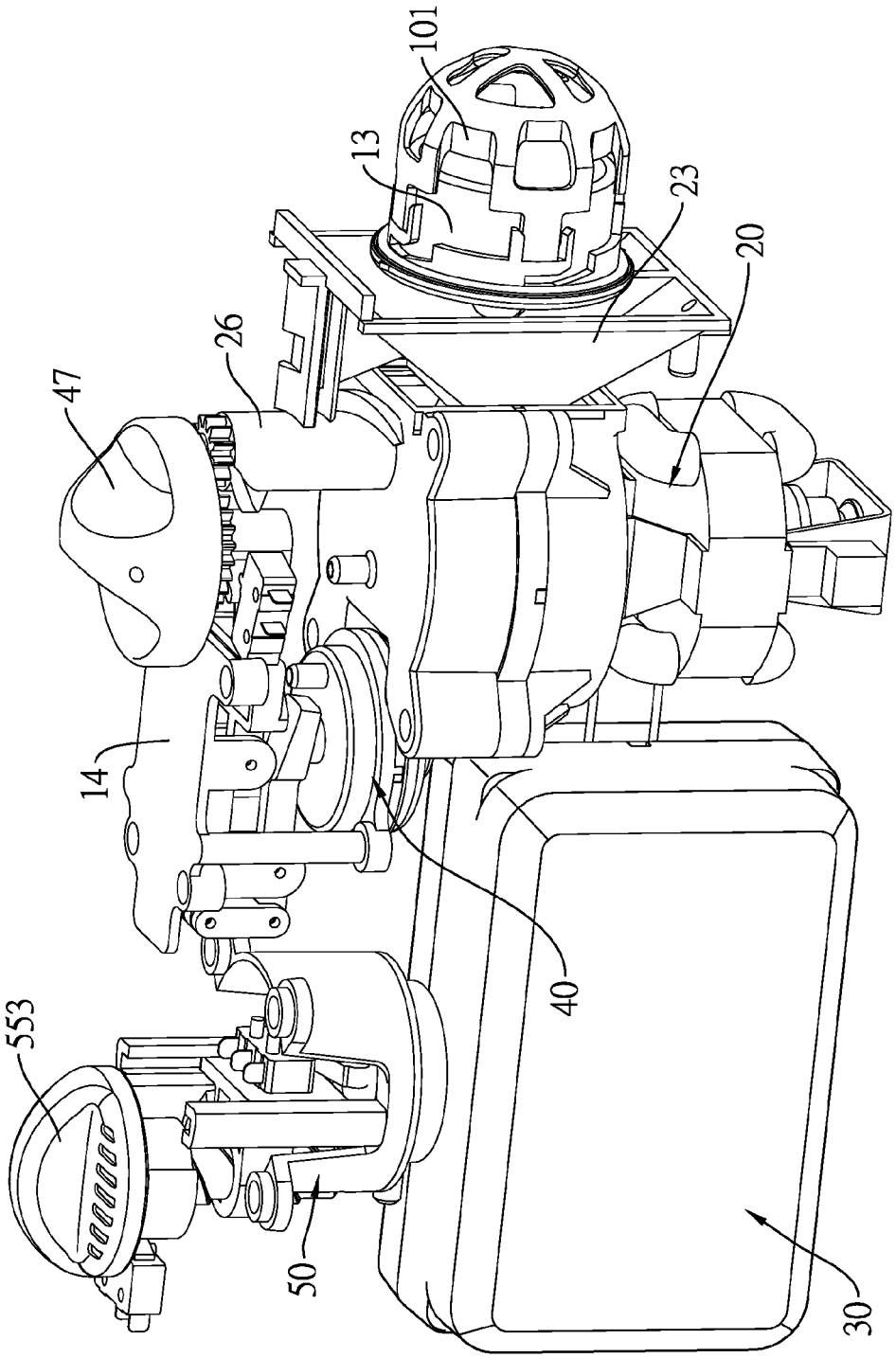

FIG. 5

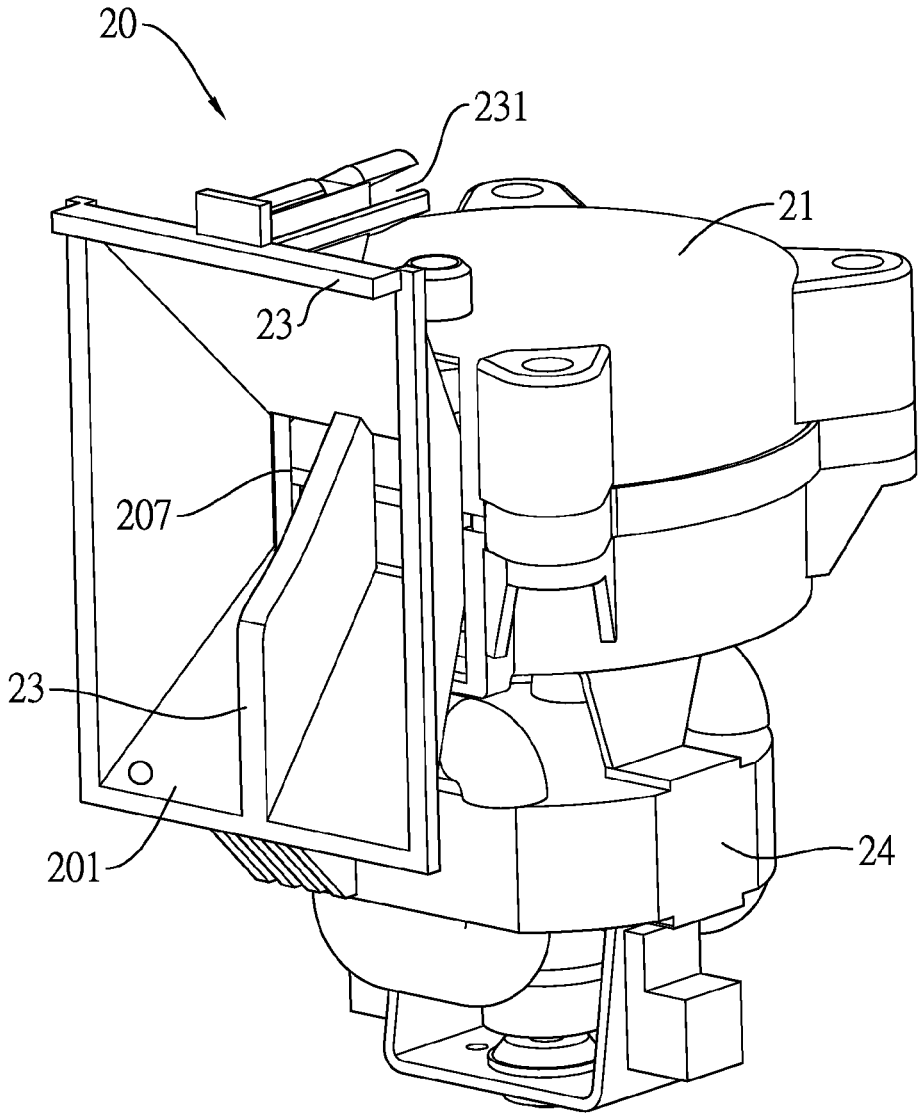

FIG. 6

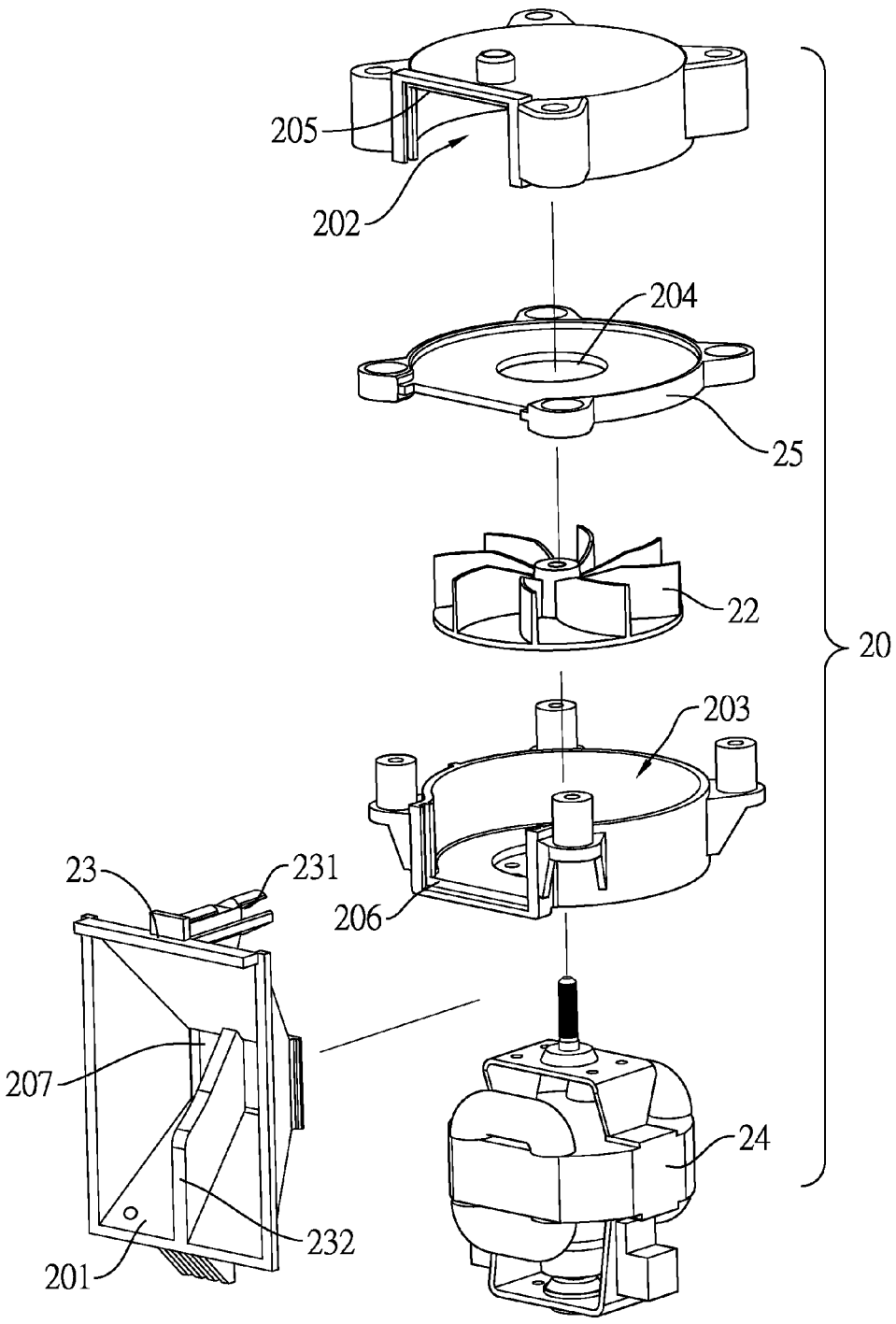

FIG. 7

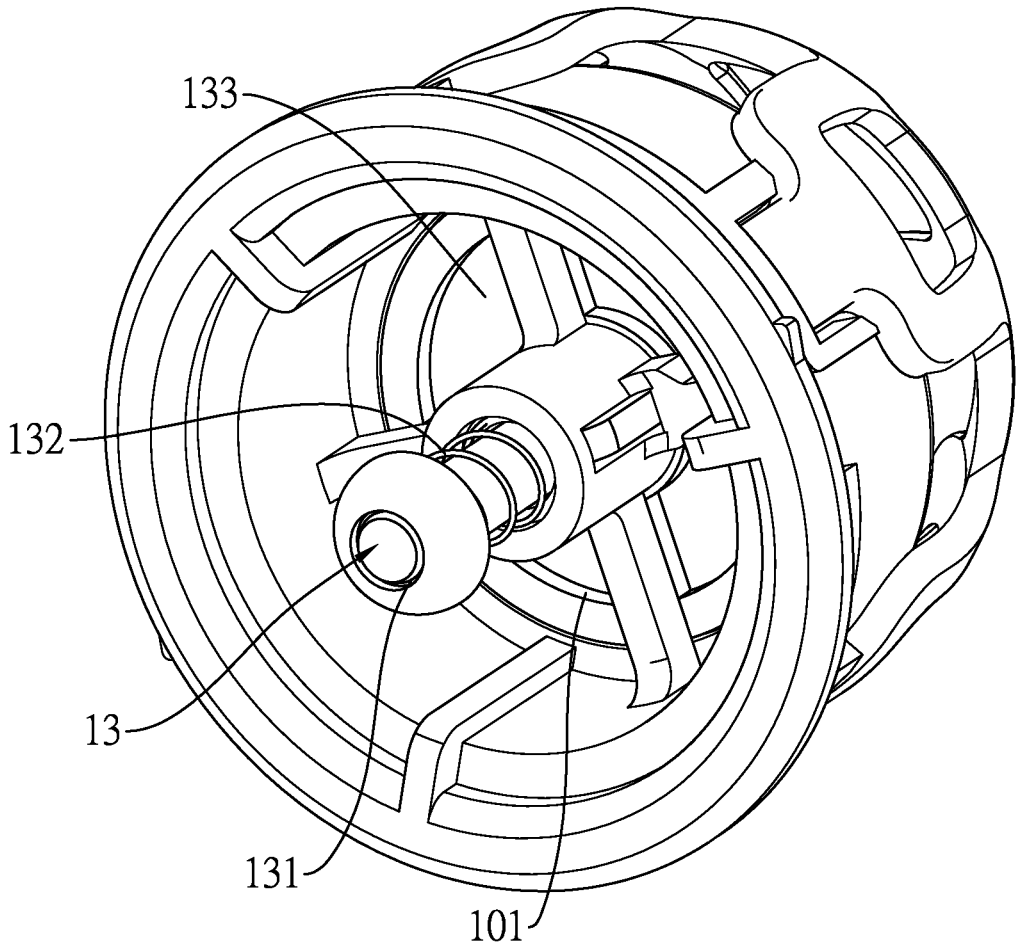

FIG. 8

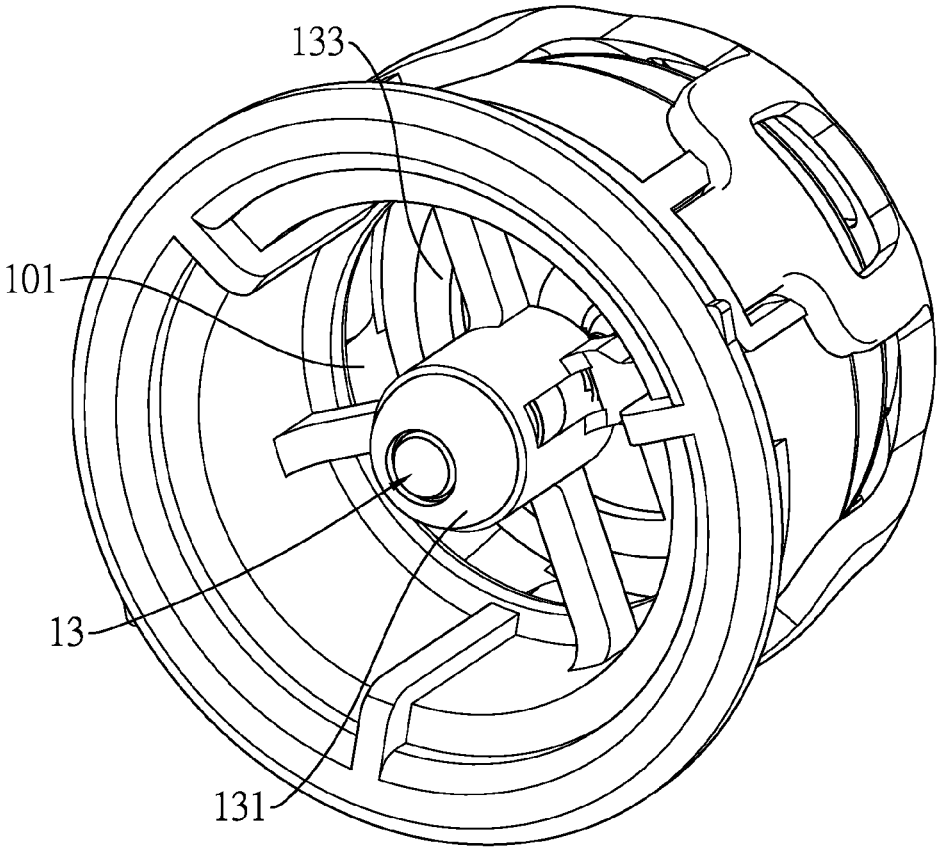

FIG. 9

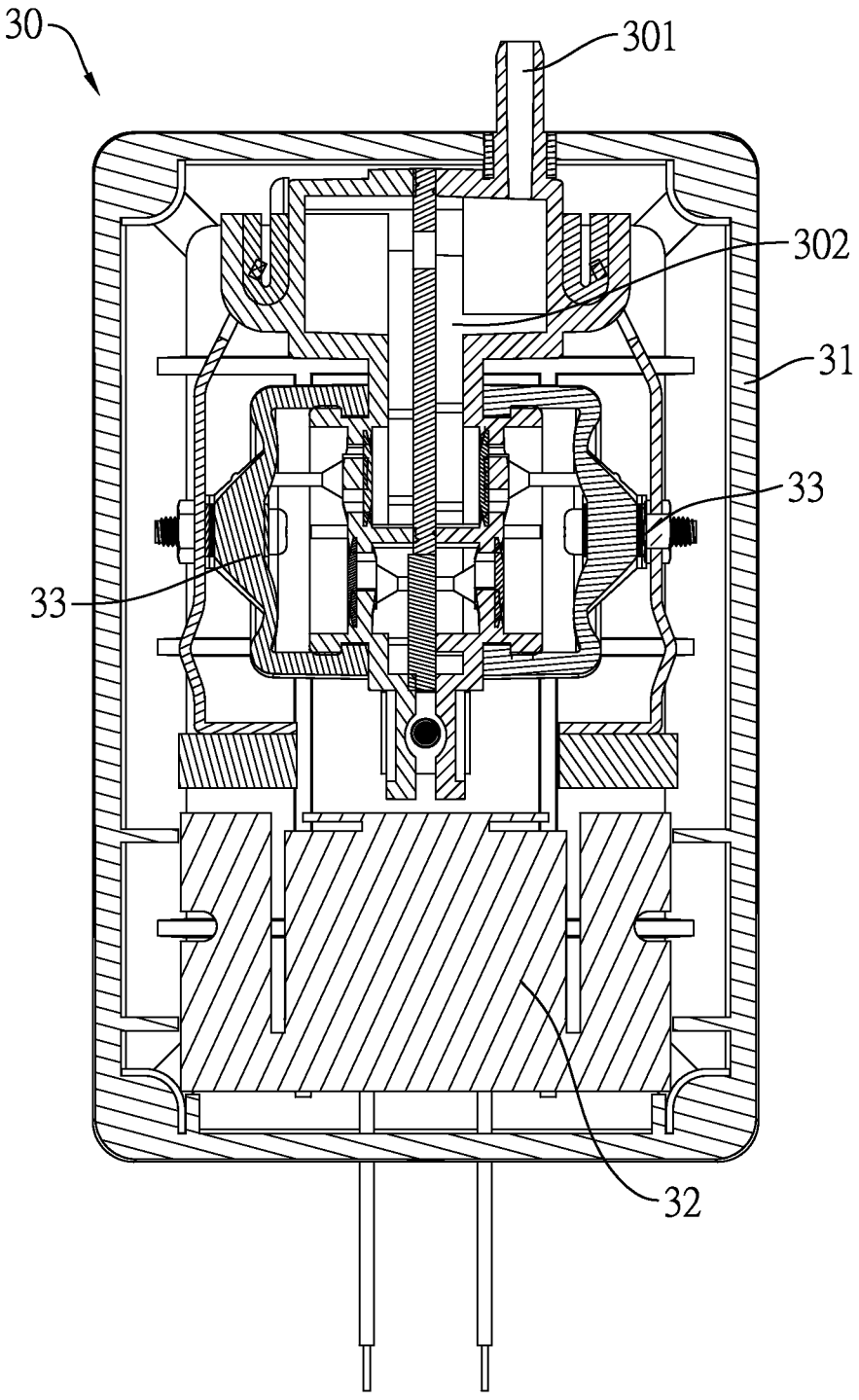

FIG. 10

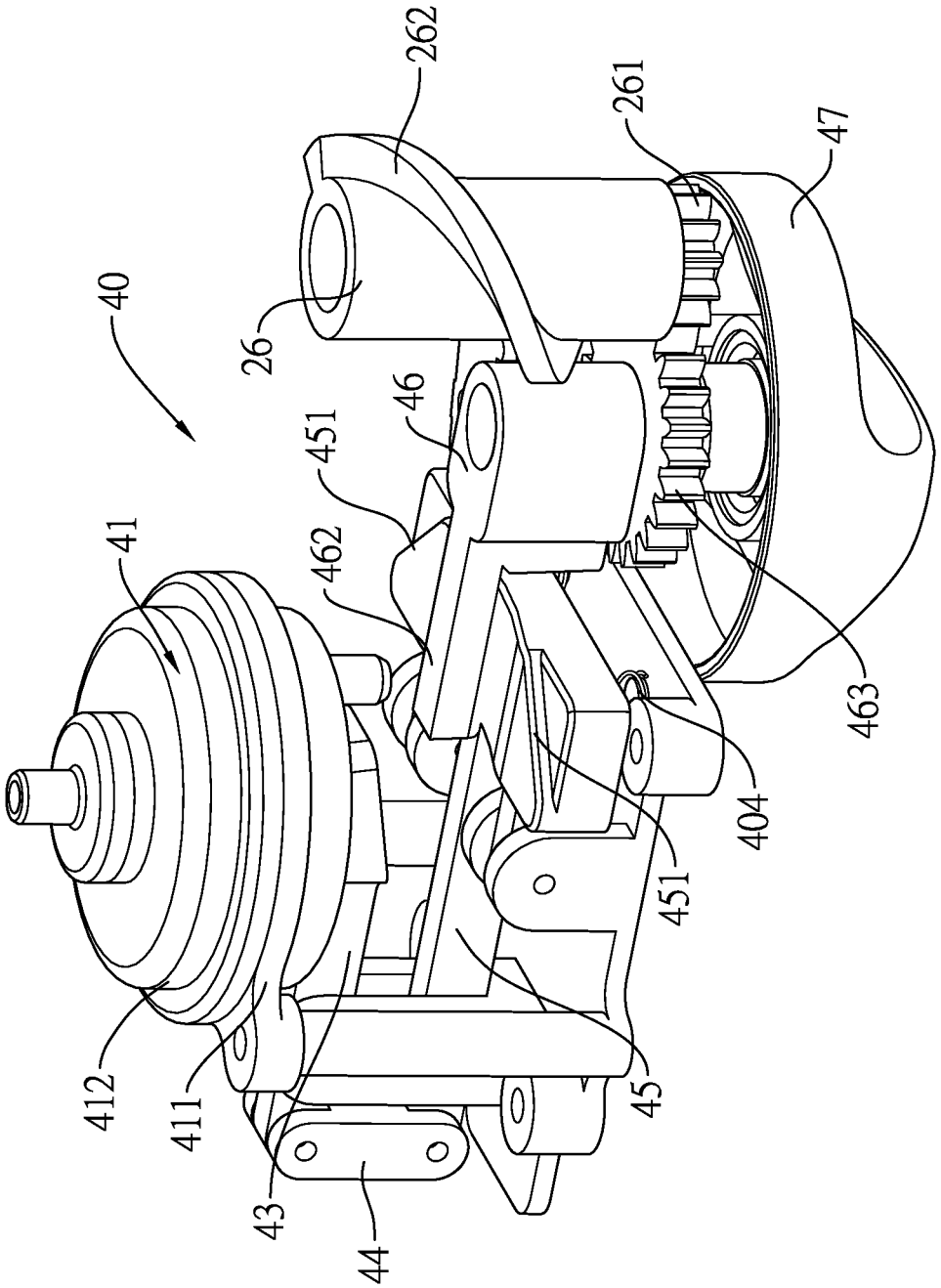

FIG. 11

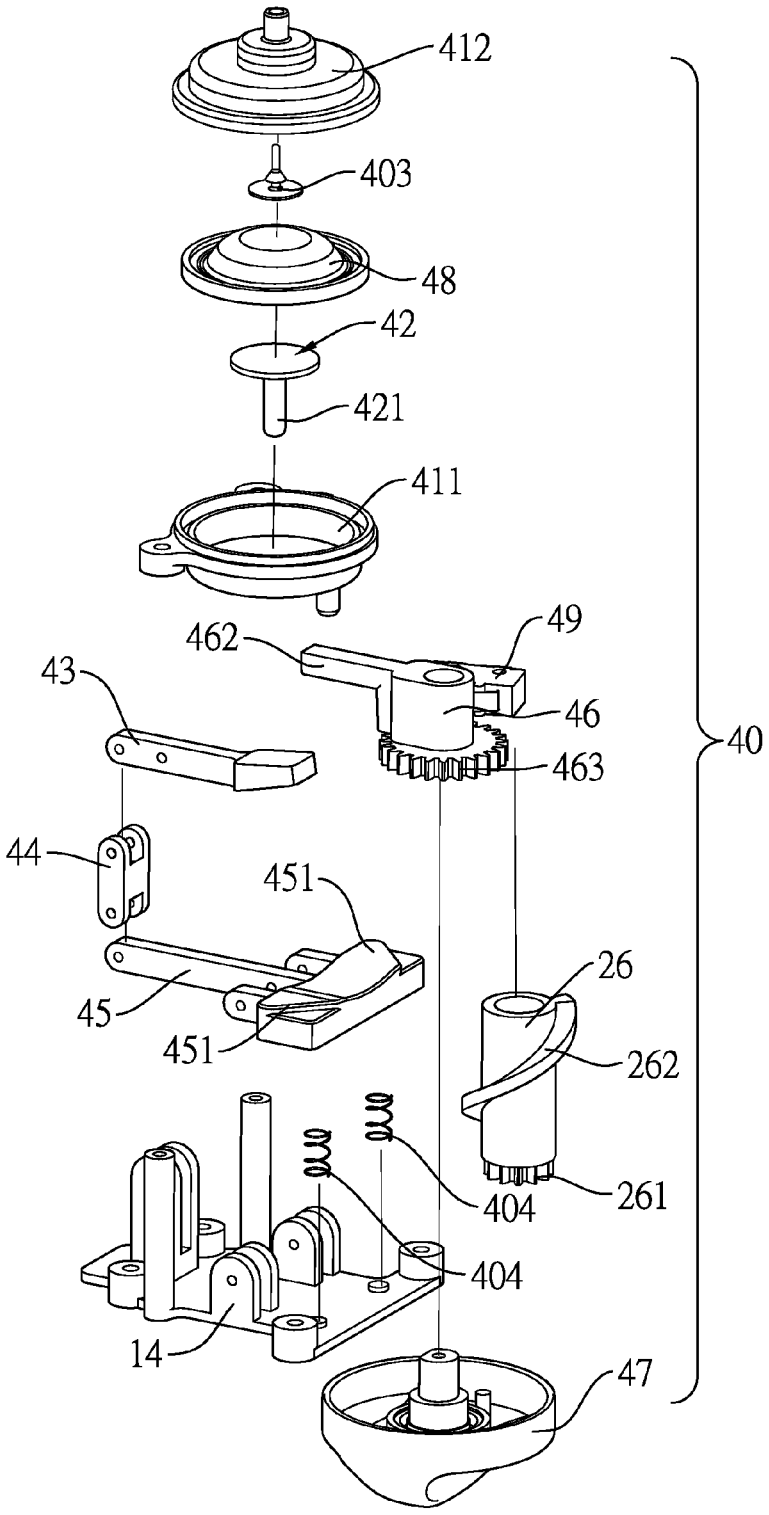
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FIG. 12

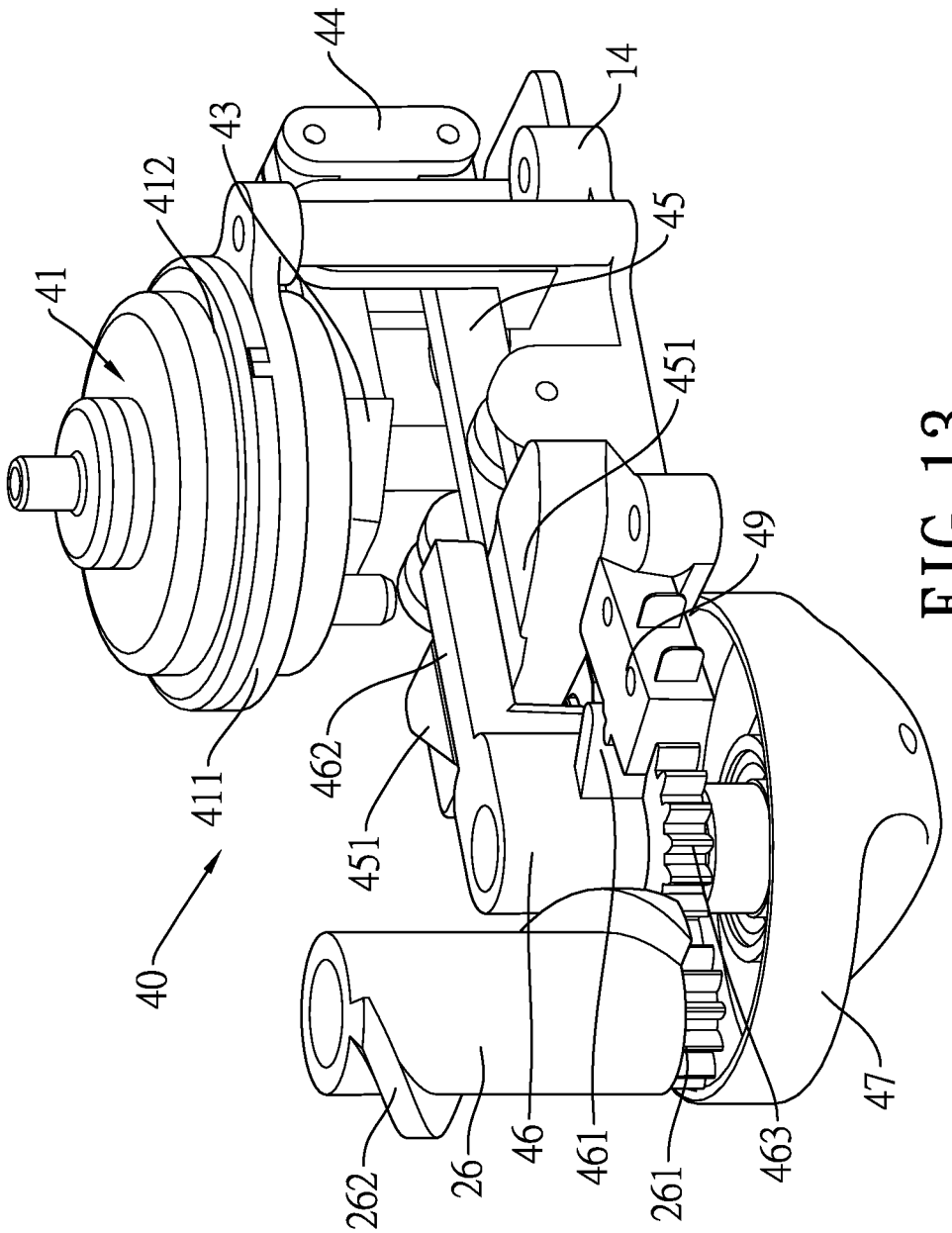

FIG. 13

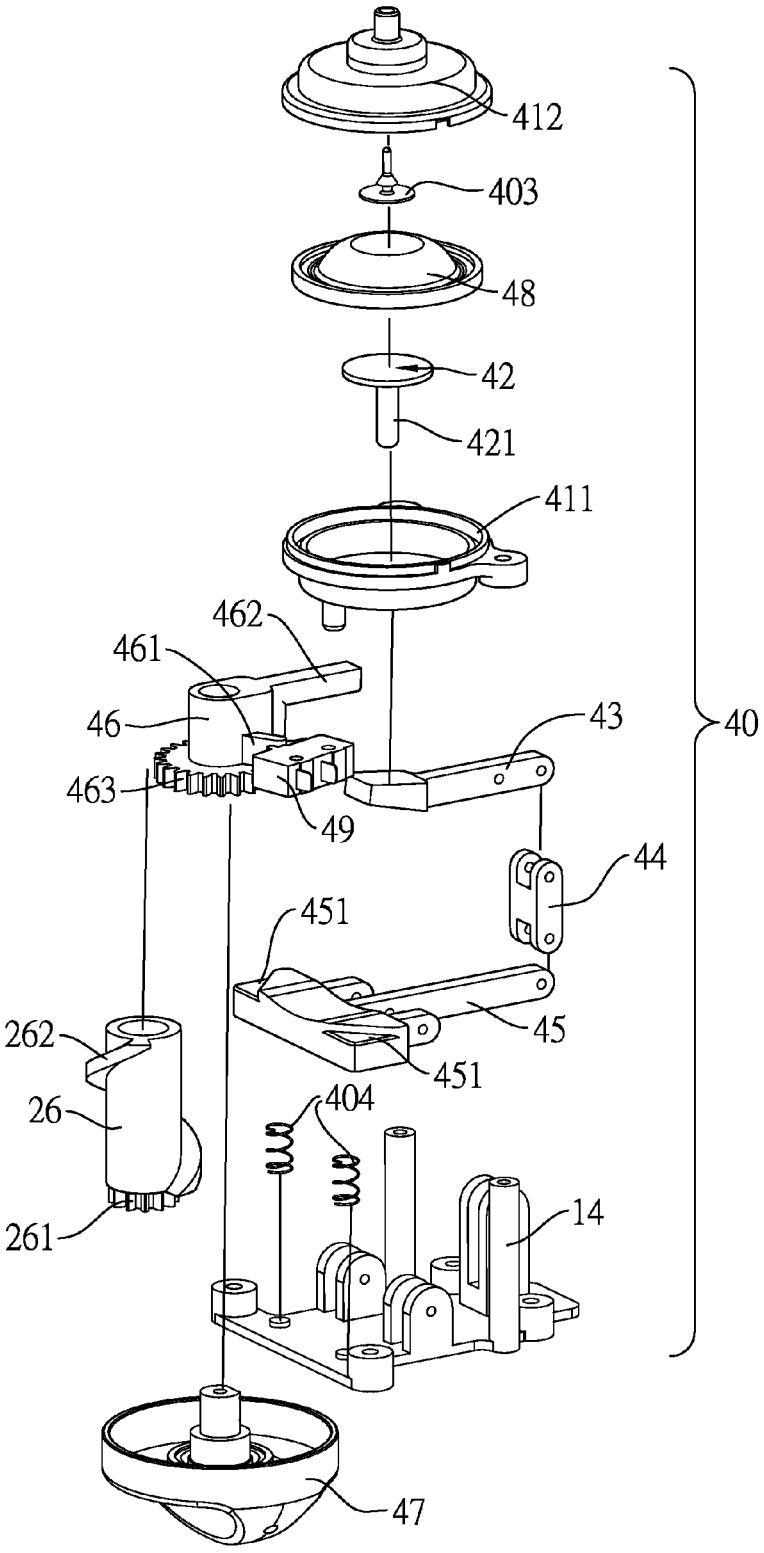
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FIG. 14

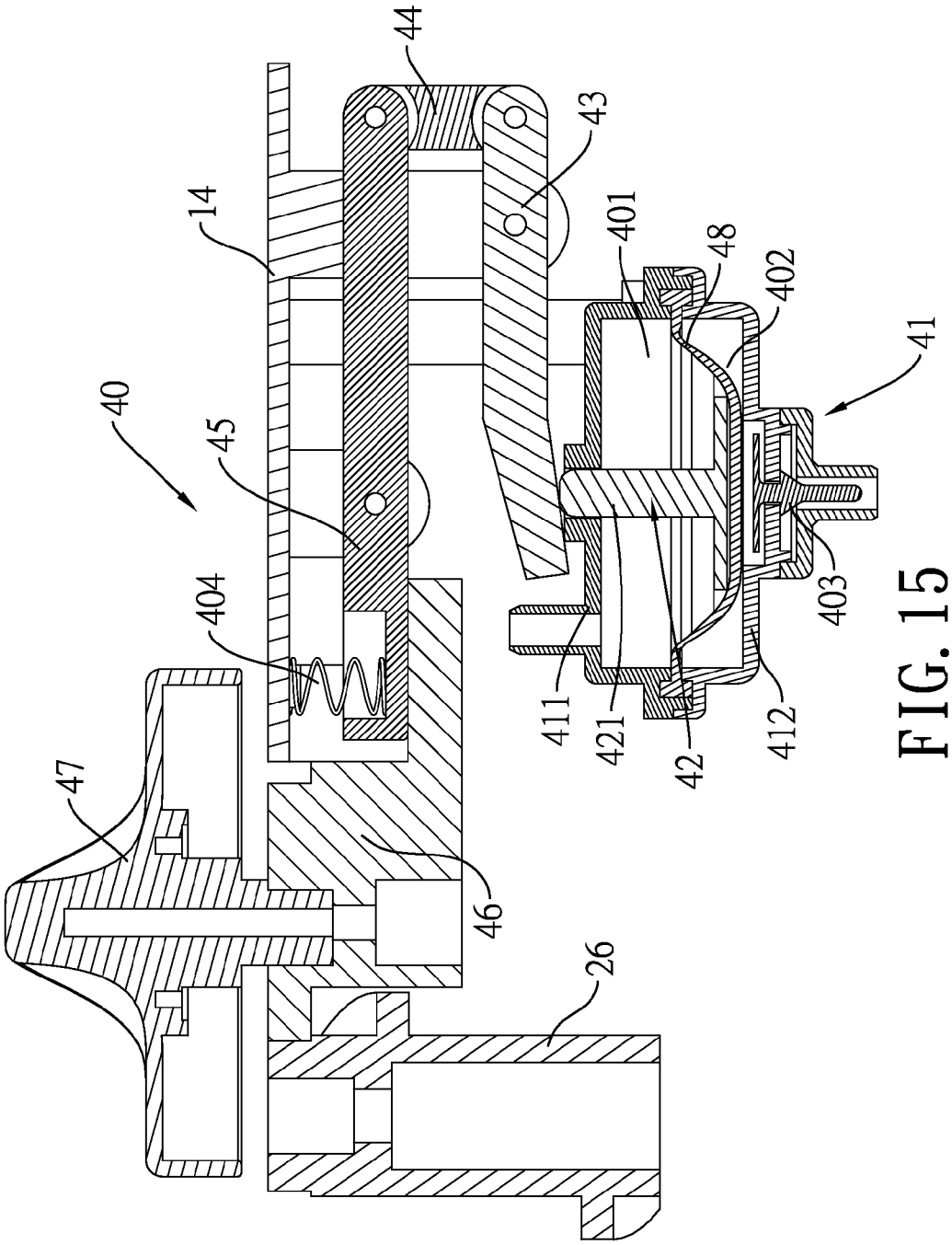

FIG. 15

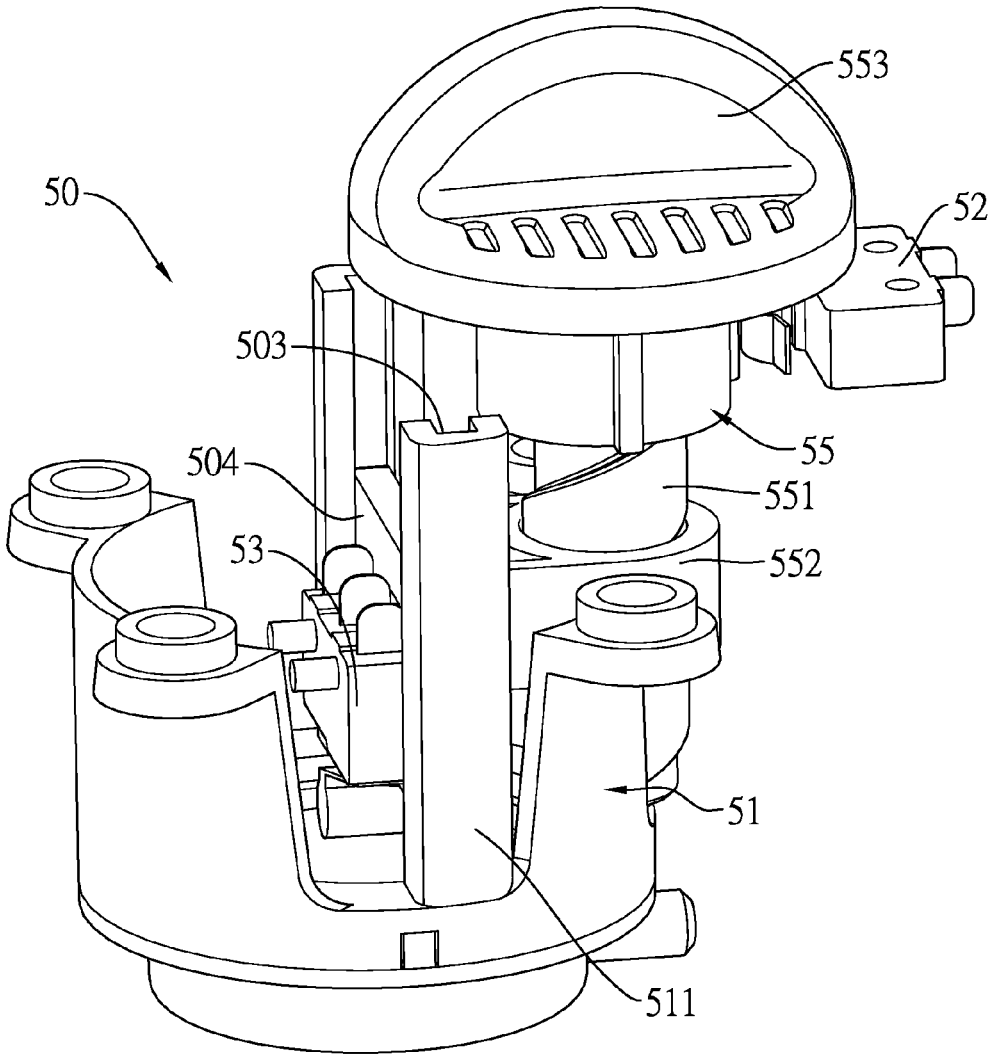

FIG. 16

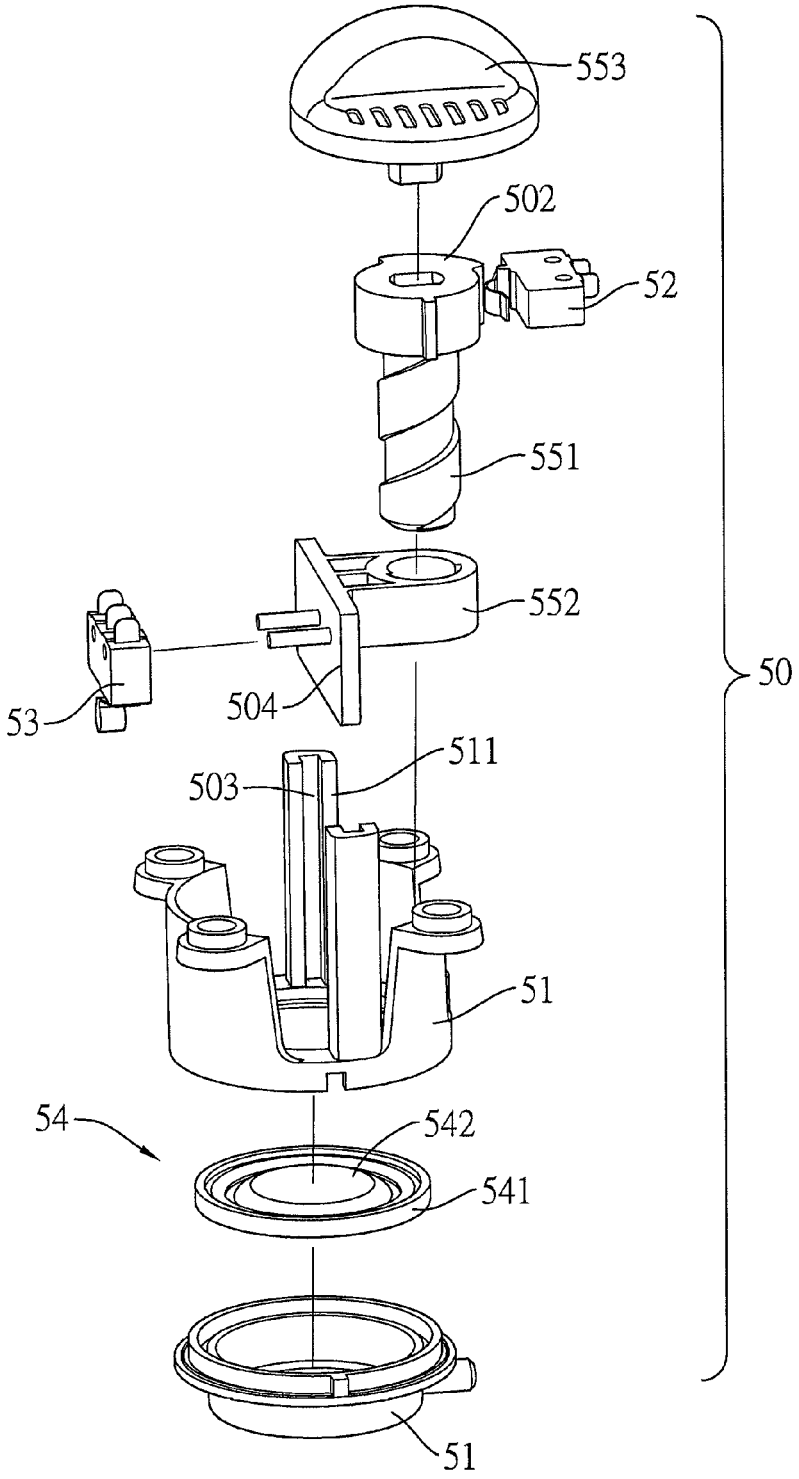

FIG. 17

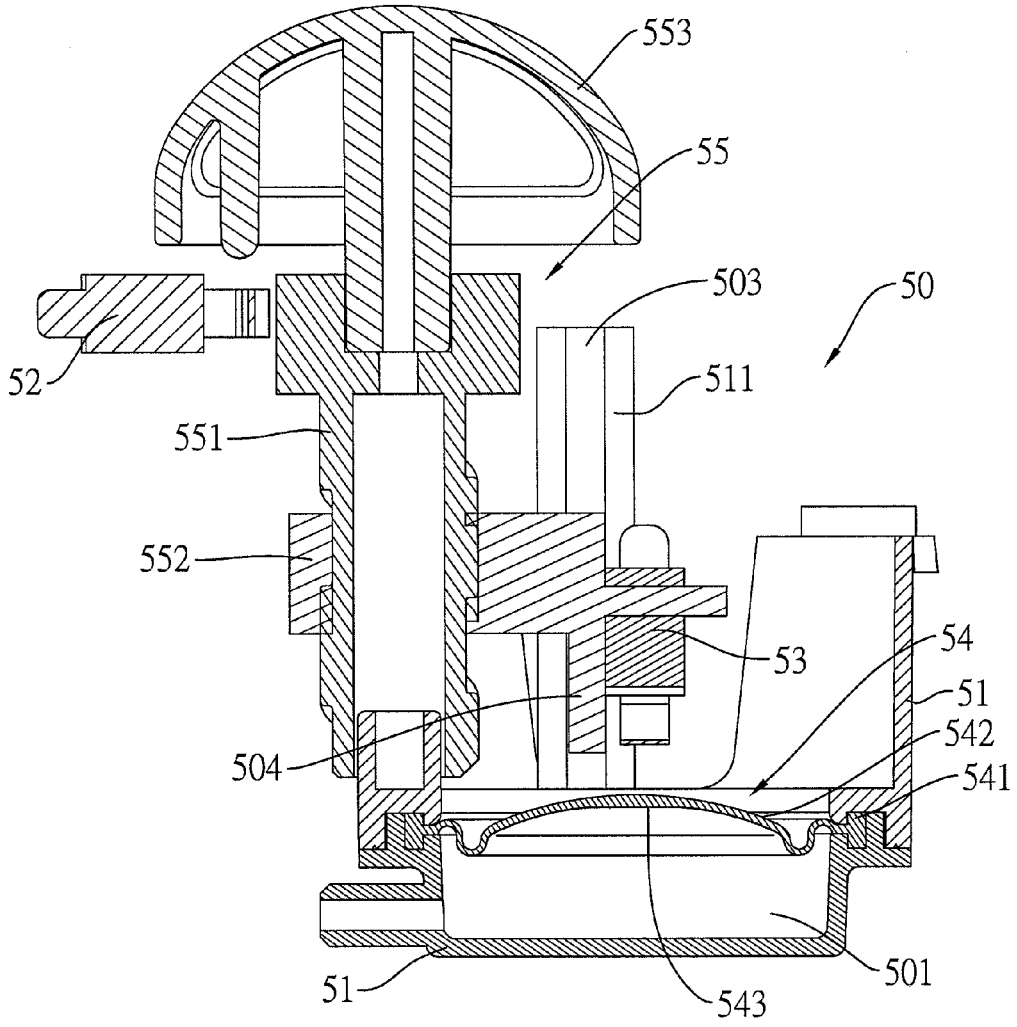

FIG. 18

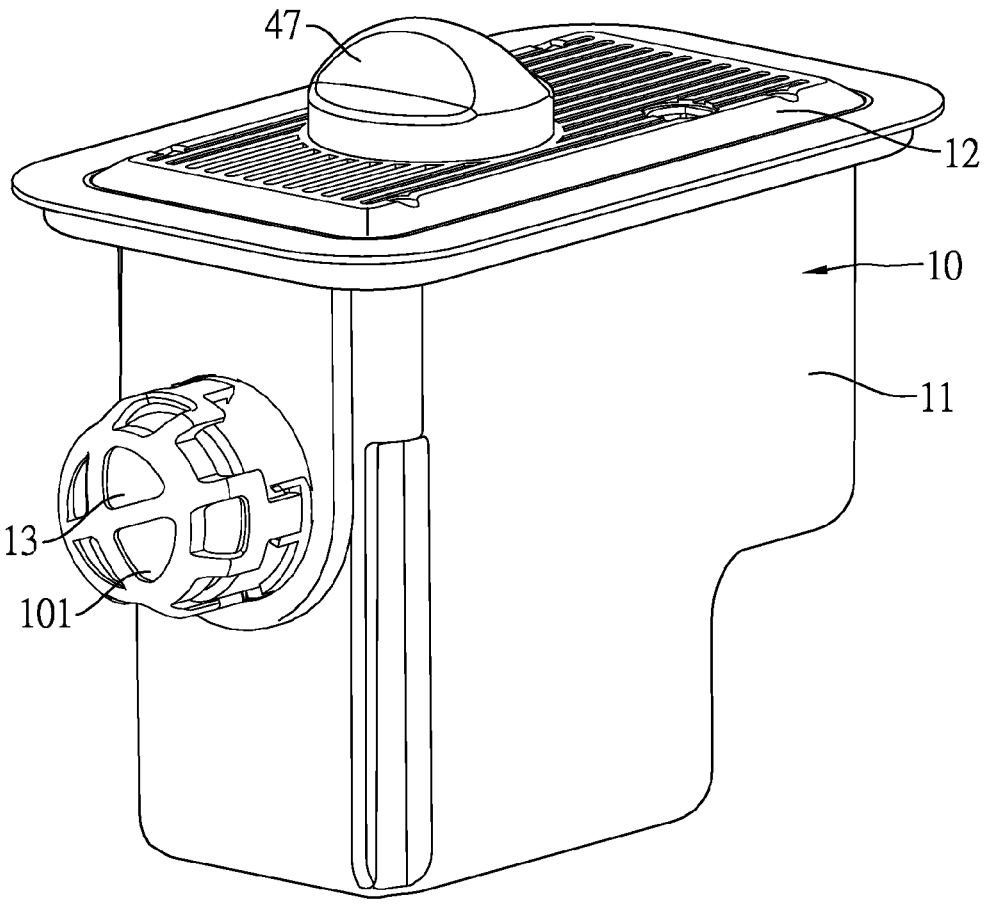

FIG. 19

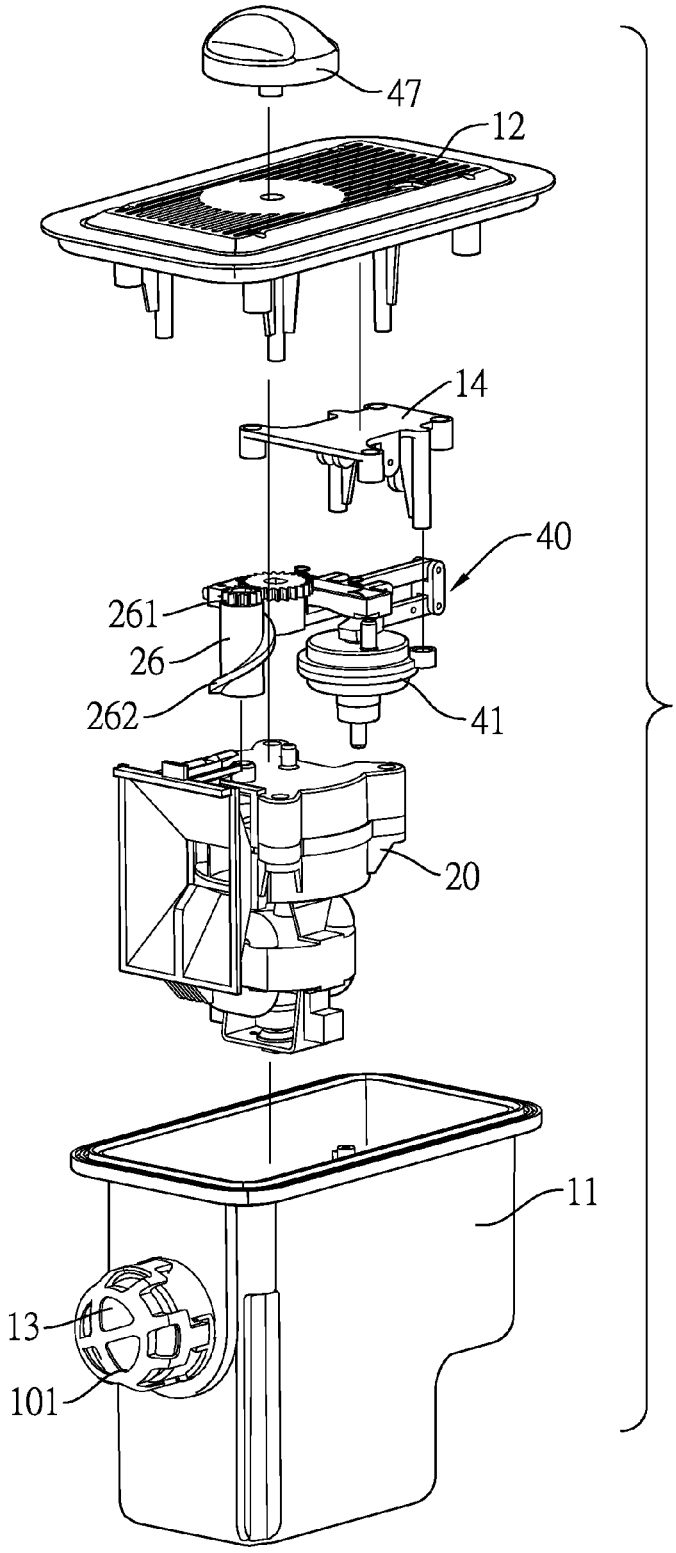

FIG. 20

AIR PUMP WITH INTERNAL AUTOMATIC CONTROLLER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an air pump, especially to an air pump with internal automatic controller.

2. Description of the Prior Art(s)

Air pumps are critical to all kinds of inflatable articles, such as airbeds, inflatable bouncers, inflatable sofas, inflatable toys, and the like. The air pump is mounted on an inner surface of the inflatable article, inflates the inflatable article and holds air inside the inflatable article at a constant pressure for use, and deflates the inflatable article for storage. Currently, some conventional air pumps can inflate and deflate the inflatable articles, and hold the air inside the inflatable articles at a constant pressure. Meanwhile, other conventional air pumps further have auto-stop controllers that stop the air pumps automatically. The auto-stop controller is mounted in a housing of the conventional air pump, and has a sensing film, a micro switch, a driving rod, a button, and a compression spring. The button is operated in a single stage, which means that when the button is pressed, the driving rod is driven to move upwardly to push the sensing film. Accordingly, the sensing film deforms upward to switch on the micro switch. When the button is released, the compression spring pushes the driving rod to move downwardly. Accordingly, the sensing film deforms downward to switch off the micro switch. The micro switch controls an operation of the conventional air pump.

The auto-stop controller allows the conventional air pump to stop working automatically, which is a great convenience to users; however, performance of the conventional air pump is still inadequate to achieve a best usage effect and a best working performance. The shortcomings of the conventional air pump are described as follows. The structure that allows the conventional air pump to stop automatically is complicated and has low stability and reliability. Moreover, the conventional air pump does not supply the air to the inflatable article automatically. Thus, when the inflatable article is deflated, the micro switch should be manually switched on in order to supply the air to the inflatable article. Furthermore, since the conventional air pump is only operated in a single stage and can only inflate the inflatable article to a specific hardness, the hardness of the inflatable article cannot be adjusted according to the user's need. Thus, the conventional air pump is inconvenient for use and operation.

To overcome the shortcomings, the present invention provides an air pump with internal automatic controller to mitigate or obviate the aforementioned problems.

SUMMARY OF THE INVENTION

The main objective of the present invention is to provide an air pump with internal automatic controller. The air pump has a housing, and a low-pressure blower, a high-pressure blower, a first auto-stop controller and a second auto-stop controller mounted in the housing. The first auto-stop controller has a first casing, a first air pressure sensing film, a pushing element, a swing rod, a connecting rod, a rotation restricting element, a first micro switch, a rotational pressing rod, and a first turning button. The first air pressure sensing film is securely mounted in the first casing and divides an interior of the first casing into a first chamber and a second chamber.

With the low-pressure blower inflating an inflatable article with low pressure air, and with the pushing element, the swing rod, the connecting rod, the rotation restricting element, the rotational pressing rod, the first turning button, the first air pressure sensing film, and the first micro switch stably and reliably controlling the low-pressure blower, the low-pressure blower stops working automatically. The first auto-stop controller has simplified structure and inflates the inflatable article without manual work, which is a great convenience to users.

Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front perspective view of a first embodiment of an air pump with internal automatic controller in accordance with the present invention;

FIG. **2** is a rear lower perspective view of the air pump in FIG. **1**;

FIG. **3** is an exploded perspective view of the air pump in FIG. **1**;

FIG. **4** is another exploded perspective view of the air pump in FIG. **1**;

FIG. **5** is a perspective view of the air pump in FIG. **1**, shown with a housing omitted;

FIG. **6** is a perspective view of a low-pressure blower of the air pump in FIG. **1**;

FIG. **7** is an exploded perspective view of the low-pressure blower in FIG. **6**;

FIG. **8** is a perspective view of a first one-way valve of the air pump in FIG. **1**, shown closed;

FIG. **9** is an operational perspective view of the first one-way valve in FIG. **8**, shown open;

FIG. **10** is a side view in partial section of a high-pressure blower of the air pump in FIG. **1**;

FIG. **11** is a perspective view of a first auto-stop controller of the air pump in FIG. **1**, shown disposed upside down;

FIG. **12** is an exploded perspective view of the first auto-stop controller in FIG. **11**, shown disposed upside down;

FIG. **13** is another perspective view of the first auto-stop controller in FIG. **11**, shown disposed upside down;

FIG. **14** is another exploded perspective view of the first auto-stop controller in FIG. **11**, shown disposed upside down;

FIG. **15** is a side view in partial section of the first auto-stop controller in FIG. **11**;

FIG. **16** is a perspective view of a second auto-stop controller of the air pump in FIG. **1**;

FIG. **17** is an exploded perspective view of the second auto-stop controller in FIG. **16**;

FIG. **18** is a side view in partial section of the second auto-stop controller in FIG. **16**;

FIG. **19** is a front perspective view of a second embodiment of an air pump with internal automatic controller in accordance with the present invention; and

FIG. **20** is an exploded perspective view of the air pump in FIG. **19**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to FIGS. **1** to **4**, a first preferred embodiment of an air pump with internal automatic controller in accordance with the present invention comprises a housing **10**, and a low-pressure blower **20**, a high-pressure blower **30**, a first auto-stop controller **40**, and a second auto-stop controller **50** mounted in the housing **10**.

The housing **10** has a base **11**, a cover **12**, and a mounting chamber. The cover **12** is mounted on the base **11** and has multiple slots. The mounting chamber is defined in the housing **10**, is surrounded by the base **11** and the cover **12**, and communicates with an exterior of the housing **10** via the slots of the cover **12**. The mounting chamber is used for receiving the low-pressure blower **20**, the high-pressure blower **30**, the first auto-stop controller **40**, and the second auto-stop controller **50**.

As shown in FIGS. **1** and **2**, the housing **10** further has a first air port **101**, a second air port **102**, a third air port **103**, a first one-way valve **13** and a second one-way valve. The first air port **101**, the second air port **102**, and the third air port **103** are used for communicating with an interior of an inflatable article. The first one-way valve **13** is mounted to the first air port **101**. The second one-way valve is mounted to the second air port **102**.

With further reference to FIGS. **8** and **9**, the first one-way valve **13** has a driving rod **131**, a valve blade **133**, and a spring **132**. The valve blade **133** is mounted on an outer end of the driving rod **131** and selectively seals the first air port **101** of the housing **10**. The spring **132** is mounted around the driving rod **131** and has two opposite ends respectively abutting the housing **10** and an inner end of the driving rod **131**. Thus, the spring **132** pushes the driving rod **131** to move toward the mounting chamber of the housing **10**. Accordingly the valve blade **133** seals the first air port **101** of the housing **10**. The second one-way valve has the same structure as the first one-way valve **13** and description about the second one-way valve is omitted.

With reference to FIGS. **5** and **6**, the low-pressure blower **20** is mounted in the mounting chamber of the housing **10** and has a fourth air port **201**. The fourth air port **201** communicates with the first air port **101** of the housing **10**.

With reference to FIGS. **4** and **10**, the high-pressure blower **30** is mounted in the mounting chamber of the housing **10** and has a fifth air port **301**. The fifth air port **301** communicates with the second air port **102** of the housing **10**.

With reference to FIGS. **3** to **5**, and **11** to **15**, the first auto-stop controller **40** is mounted in the mounting chamber of the housing **10** and has a first casing **41**, a first air pressure sensing film **48**, a one-way valve blade **403**, a pushing element **42**, a swing rod **43**, a connecting rod **44**, a rotation restricting element **45**, at least one restoring spring **404**, a first micro switch **49**, a rotational pressing rod **46**, and a first turning button **47**.

The first casing **41** is formed by attaching a lid **412** onto a seat **411**.

As shown in FIG. **15**, the first air pressure sensing film **48** is securely mounted in the first casing **41** and divides an interior of the first casing **41** into a first chamber **401** and a second chamber **402**. The first chamber **401** communicates with an exterior of the first casing **41**. The second chamber **402** communicates with the third air port **103**. The one-way valve blade **403** is mounted to an inlet of the second chamber **402**. The pushing element **42** is mounted in the first chamber **401** and has a driven end **421** protruding out of the first casing **41**.

The swing rod **43** is pivotally disposed outside the first casing **41** and has a first end and a second end. The first end of the swing rod **43** faces the driven end **421** of the pushing element **42**. The connecting rod **44** has two ends. One of the ends of the connecting rod **44** is pivotally connected to the second end of the swing rod **43**. The rotation restricting element **45** is pivotally disposed outside the first casing **41**, and has a first end, a second end, and at least one limit portion **451**. The first end of the rotation restricting element **45** is pivotally connected to the other end of the connecting rod **44**. The at least one limit portion **451** is formed on the second end of the rotation restricting element **45**. The at least one restoring spring **404** is mounted on the at least one limit portion **451** of the rotation restricting element **45**.

The first micro switch **49** is disposed outside the first casing **41**. The rotational pressing rod **46** is rotatably disposed outside the first casing **41** and has a pressing portion **461** and a positioning portion **462**. The pressing portion **461** corresponds in position to and presses against the first micro switch **49**. The positioning portion **462** operates in coordination with the at least one limit portion **451** of the rotation restricting element **45**. The first turning button **47** is mounted on the housing **10** via a torsion spring and is disposed outside the housing **10**. The first turning button **47** is connected to the rotational pressing rod **46** and selectively drives the rotational pressing rod **46** to rotate.

With reference to FIGS. **3** to **5** and **16** to **18**, the second auto-stop controller **50** is mounted in the mounting chamber of the housing **10** and has a second casing **51**, a switching switch **52**, a second micro switch **53**, a second air pressure sensing film **54**, a third chamber **501**, and an adjusting control mechanism **55**.

The second casing **51** has an inner surface. The switching switch **52** is electrically connected to the high-pressure blower **30** and selectively switches the high-pressure blower **30** on or off. The second micro switch **53** is electrically connected to the high-pressure blower **30** and selectively switches the high-pressure blower **30** on or off. The second air pressure sensing film **54** is mounted in the second casing **51**, selectively triggers the second micro switch **53**, and has a peripheral edge **541**, an outer surface **542**, and an inner surface **543**. The peripheral edge **541** of the second air pressure sensing film **54** is attached to the inner surface **543** of the second casing **51**. The outer surface of **542** of the second air pressure sensing film **54** faces and is disposed apart from the second micro switch **53**. The inner surface **543** of the second air pressure sensing film **54** is opposite to the outer surface **542** of the second air pressure sensing film **54**. The third chamber **501** is surrounded by the inner surface **543** of the second air pressure sensing film **54** and the inner surface of the second casing **51**, and communicates with the third air port **103** of the housing **10**. The adjusting control mechanism **55** selectively triggers the switching switch **52**, and drives the second micro switch **53** to move toward or away from the second air pressure sensing film **54**.

Specifically, in the first preferred embodiment, the adjusting control mechanism **55** has a bolt **551**, a nut **552**, and a second turning button **553**. The bolt **551** is rotatably mounted outside the second casing **51** and has a triggering protrusion **502**. The triggering protrusion **502** selectively triggers the switching switch **52**. The nut **552** is screwed on the bolt **551** and is rotatable to move along an axial direction of the bolt **551**. The second micro switch **53** is securely mounted on the nut **552** and moves along with the nut **552**. The second turning button **553** is disposed outside the housing **10**, and is connected to and selectively drives the bolt **551** to rotate.

In the first preferred embodiment, the second casing **51** further has two guiding portions **511**. Each of the guiding portions **511** has a guiding slot **503**. The nut **552** has a positioning panel **504**. The positioning panel **504** has two opposite side edges respectively engaging in the guiding slots **503** of the guiding portions **511**, such that the positioning panel **504** can slide along the guiding slots **503**. The second micro switch **53** is securely mounted on the positioning panel **504**.

With reference to FIGS. **5** to **7**, specifically, in the first preferred embodiment, the low-pressure blower **20** further

has a third casing **21**, a dividing panel **25**, an impeller **22**, a switching casing **23**, a motor **24**, and an air control mechanism **26**.

The third casing **21** has an inlet port **205** and an outlet port **206**. The dividing panel **25** is mounted in the third casing **21** and divides an interior of the third casing **21** into an inlet chamber **202** and an outlet chamber **203**. The inlet chamber **202** communicates with the inlet port **205**. The outlet chamber **203** communicates with the outlet port **206**. The dividing panel **25** has a through hole **204**. The impeller **22** is mounted in the outlet chamber **203** and has an air-inlet portion and an air-outlet portion. The air-inlet portion of the impeller **22** corresponds in position to the through hole **204** of the dividing panel **25**. The air-outlet portion of the impeller **22** corresponds in position to the outlet port **206** of the third casing **21**. The switching casing **23** is mounted between the first air port **101** of the housing **10** and the third casing **21** and has an air channel **207**. The second chamber **402** of the first casing **41** communicates with the air channel **207**. The air channel **207** selectively communicates with the inlet port **205** of the third casing **21** or the outlet port **206** of the third casing **21**. The motor **24** drives the impeller **22** to rotate. The air control mechanism **26** drives the switching casing **23** to allow the air channel **207** of the switching casing **23** to selectively communicate with the inlet port **205** or the outlet port **206**.

With reference to FIGS. **5** and **11** to **14**, in the first preferred embodiment, the air control mechanism **26** is a screw and is rotatably mounted on the third casing **21**. The air control mechanism **26** has a distal end, a peripheral surface, multiple first gear teeth **261**, and a spiral rib **262**. The first gear teeth **261** are arranged around the distal end of the air control mechanism **26**. The rotational pressing rod **46** further has multiple second gear teeth **463** engaged with the first gear teeth **261** of the air control mechanism **26**. The spiral rib **262** is formed on the peripheral surface of the air control mechanism **26**. The switching casing **23** further has an engaging portion **231** engaged with the spiral rib **262** of the air control mechanism **26**.

Moreover, the switching casing **23** further has a pressing protrusion **232** selectively opening the first one-way valve **13**. When the pressing protrusion **232** of the switching casing **23** presses against the first one-way valve **13**, the first one-way valve **13** is open and the air channel **207** communicates with the inlet port **205** of the third casing **21**. When the pressing protrusion **232** of the switching casing **23** departs from the first one-way valve **13**, the first one-way valve **13** is closed and the air channel **207** communicates with the outlet port **206** of the third casing **21**.

Furthermore, specifically, the rotation restricting element **45** has two limit portions **451** separately formed on the second end of the rotation restricting element **45**. The first auto-stop controller **40** has two restoring springs **404** respectively mounted on the two limit portions **451** of the rotation restricting element **45**. A support bracket **14** is mounted in the housing **10**. The first casing **41**, the swing rod **43**, and the rotation restricting element **45** are assembled on the support bracket **14**. Two opposite ends of each of the restoring springs **404** respectively abut the support bracket **14** and the rotation restricting element **45**.

With reference to FIG. **10**, the high-pressure blower **30** further has a fourth casing **31**, an electromagnetic assembly **32**, and two open-close mechanisms **33**. The electromagnetic assembly **32** and the open-close mechanisms **33** are mounted in the fourth casing **31**. The open-close mechanisms **33** are connected to the electromagnetic assembly **32** and are driven to open or to close relative to each other by the electromagnetic assembly **32**. When the open-close mechanisms **33** are open relative to each other, an air chamber **302** is formed between the open-close mechanisms **33** and communicates with the fifth air port **301** of the high-pressure blower **30**.

The air pump with internal automatic controller works as follows.

For inflation, a position of the second micro switch **53** can be adjusted according to a demand for hardness of the inflatable article. Specifically, the second turning button **553** is turned to rotate the bolt **551** and to allow the nut **552** to move along the bolt **551** to a proper position. Accordingly, the second micro switch **53** moves along with the nut **552** to the proper position. As the distance defined between the second micro switch **53** and the second air pressure sensing film **54** is longer, the inflatable article is harder after inflating. As the distance defined between the second micro switch **53** and the second air pressure sensing film **54** is shorter, the inflatable article is softer after inflating. As the second turning button **553** is turned, the triggering protrusion **502** triggers the switching switch **52**.

Then, the first turning button **47** is turned to sequentially drive the rotational pressing rod **46** and the air control mechanism **26** to rotate. As the air control mechanism **26** rotates, the switching casing **23** is driven to move downward to allow the air channel **207** of the switching casing **23** to communicate with the outlet port **206** of the third casing **21** and the fourth air port **201** of the low-pressure blower **20**. Thus, the inlet port **205** of the third casing **21** communicates with the exterior of the housing **10**.

Meanwhile, the pressing portion **461** of the rotational pressing rod **46** presses against the first micro switch **49**, and the positioning portion **462** of the rotational pressing rod **46** is held in position by one of the limit portions **451** of the rotation restricting element **45**. Accordingly, the low-pressure blower **20** begins working. The motor **24** drives the impeller **22** to rotate, thereby forming an air current. The air current pushes and opens the first one-way valve **13** and inflates the inflatable article. When an air pressure inside the inflatable article increases, an air pressure inside the second chamber **402** of the first casing **41** increases accordingly, and the first air pressure sensing film **48** deforms upward. When the air pressure inside the inflatable article achieves a pre-set low pressure, the first air pressure sensing film **48** pushes the pushing element **42**, such that the driven end **421** of the pushing element **42** pushes the swing rod **43** to pivot and the rotation restricting element **45** is driven to rotate via the connecting rod **44**. Consequently, the limit portions **451** of the rotation restricting element **45** depart from the positioning portion **462** of the rotational pressing rod **46**. The rotational pressing rod **46** is restored to its original position, the pressing portion **461** of the rotational pressing rod **46** departs from the first micro switch **49**, and the low-pressure blower **20** stops working.

Meanwhile, as the switching switch **52** is triggered and is switched on, the high-pressure blower **30** begins working. The electromagnetic assembly **32** drives the open-close mechanisms **33** to open or to close relative to each other and to compress air into the inflatable article. Thus, the air pressure inside the inflatable article increases continuously, an air pressure inside the third chamber **501** of the second casing **51** increases accordingly, and the second air pressure sensing film **54** deforms upward. When the air pressure inside the inflatable article achieves a pre-set high pressure, the second micro switch **53** is triggered by the second air pressure sensing film **54**, and the high-pressure blower **30** stops working.

As the inflatable article is deflated slightly, the second air pressure sensing film **54** departs from the second micro switch **53**, the high-pressure blower **30** is switched on automatically to inflate the inflatable article with high pressure air.

When the air pressure inside the inflatable article achieves the pre-set high pressure again, the second micro switch **53** is triggered by the second air pressure sensing film **54**, such that the high-pressure blower **30** stops working. Consequently, the air pressure inside the inflatable article is kept at the pre-set high pressure.

As for deflation, the second turning button **553** is turned to rotate the bolt **551** and to allow the triggering protrusion **502** of the bolt **551** to depart from the switching switch **52**. Then the first turning button **47** is turned reversely to sequentially drive the rotational pressing rod **46** and the air control mechanism **26** to rotate. As the air control mechanism **26** rotates, the switching casing **23** is driven to move upward to allow the air channel **207** of the switching casing **23** to communicate with the inlet port **205** of the third casing **21** and the fourth air port **201** of the low-pressure blower **20**. Thus, the outlet port **206** of the third casing **21** communicates with the exterior of the housing **10**.

Meanwhile, the pressing protrusion **232** of the switching casing **23** presses against the driving rod **131** of the first one-way valve **13** to open the first one-way valve **13**. Thus, air inside the inflatable article discharges through the first air port **101** of the housing **10**, the fourth air port **201** of the low-pressure blower **20**, the air channel **207** of the switching casing **23**, the inlet port **205** of the third casing **21**, the inlet chamber **202** of the third casing **21**, the outlet chamber **203** of the third casing **21**, and the outlet port **206** of the third casing **21** in sequence.

Meanwhile, the pressing portion **461** of the rotational pressing rod **46** presses against the first micro switch **49**, and the positioning portion **462** of the rotational pressing rod **46** is held in position by the other one of the limit portions **451** of the rotation restricting element **45**. Accordingly, the low-pressure blower **20** begins working. The motor **24** drives the impeller **22** to rotate to accelerate a speed of discharging the air inside the inflatable article. With the air pressure inside the inflatable article decreases, the one-way valve blade **403** seals the inlet of the second chamber **402**, such that the air pressure inside the second chamber **402** remains steady. Meanwhile, the air pressure inside the first chamber **401** decreases accordingly, and the first air pressure sensing film **48** deforms upward. When the air inside the inflatable article is discharged completely, the first air pressure sensing film **48** pushes the pushing element **42**, such that the driven end **421** of the pushing element **42** pushes the swing rod **43** to pivot and the rotation restricting element **45** is driven to rotate via the connecting rod **44**. Consequently, the limit portions **451** of the rotation restricting element **45** depart from the positioning portion **462** of the rotational pressing rod **46**. The rotational pressing rod **46** is restored to its original position, the pressing portion **461** of the rotational pressing rod **46** departs from the first micro switch **49**, and the low-pressure blower **20** stops working.

With reference to FIGS. **19** and **20**, a second preferred embodiment of an air pump with internal automatic controller in accordance with the present invention is shown. Differences between the second preferred embodiment and the first preferred embodiment are as follows.

In the second preferred embodiment, the low-pressure blower **20** and the first auto-stop controller **40** are mounted in the housing **10**. The high-pressure blower **30** and the second auto-stop controller **50** are omitted. Structures of the low-pressure blower **20** and the first auto-stop controller **40** of the second preferred embodiment are the same as structures of the low-pressure blower **20** and the first auto-stop controller **40** of the first preferred embodiment. Thus, descriptions about the low-pressure blower **20** and the first auto-stop controller **40** of the second preferred embodiment are omitted.

Working processes of the second preferred embodiment of the air pump are basically the same as working processes of the first preferred embodiment of the air pump.

The air pump as described has the main technical features as follows. With the low-pressure blower **20** inflating the inflatable article with low pressure air, and with the pushing element **42**, the swing rod **43**, the connecting rod **44**, the rotation restricting element **45**, the rotational pressing rod **46**, the first turning button **47**, the first air pressure sensing film **48**, and the first micro switch **49** stably and reliably controlling the low-pressure blower **20**, the low-pressure blower **20** stops working automatically. The first auto-stop controller **40** has simplified structure and inflates the inflatable article without manual work, which is a great convenience to users.

Moreover, with the high-pressure blower **30** inflating the inflatable article with high pressure air, and with the second micro switch **53** adjustably disposed above the second air pressure sensing film **54**, the inflatable article can be inflated with the high pressure air in order to have hardness suitable for the user's need. As the air pressure inside the inflatable article achieves the pre-set high pressure, the second air pressure sensing film **54** presses against the second micro switch **53** to stop the high-pressure blower **30**, such that the air pump can stop working when inflating with high pressure air automatically.

When the air pressure inside the inflatable article decreases, the second air pressure sensing film **54** departs from the second micro switch **53**, such that the high-pressure blower **30** begins working automatically. The air pump can supply air when inflating with high pressure air automatically, and can inflate the inflatable article to the hardness suitable for the user's need.

Furthermore, by turning the second turning button **553** to rotate the bolt **551**, the nut **552** can move along the bolt **551** back and forth, and the second micro switch **53** selectively departs from or approaches the second air pressure sensing film **54**. Positions of the second micro switch **53** are adjusted steplessly, so that the inflatable article can be inflated to the hardness that is most suitable for the user's need. The second auto-stop controller **50** has simplified structure and can be operated conveniently and rapidly, which is a great convenience to the users.

With the switching casing **23** driven by the air control mechanism **26**, the air channel **207** of the switching casing **23** selectively communicates with the inlet port **205** or the outlet port **206** of the third casing **21**. When the air channel **207** communicates with the inlet port **205**, the first one-way valve **13** is open so as to inflate the inflatable article. Thus, the air pump not only can inflate the inflatable article, but also can deflate the inflatable article rapidly. The air pump as described has simplified structure, is convenient for assembling, and can achieve high manufacturing efficiency and low manufacturing cost.

Even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and features of the invention, the disclosure is illustrative only. Changes may be made in the details, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. An air pump with an internal automatic controller comprising:

a housing having

a first air port;

a second air port;

a third air port;

a first one-way valve mounted to the first air port; and

a second one-way valve mounted to the second air port;

a low-pressure blower mounted in the housing and having a fourth air port communicating with the first air port;

a high-pressure blower mounted in the housing and having a fifth air port communicating with the second air port of the housing;

a first auto-stop controller mounted in the housing and having

a first casing;

a first air pressure sensing film securely mounted in the first casing and dividing an interior of the first casing into a first chamber and a second chamber, the first chamber communicating with an exterior of the first casing, and the second chamber communicating with the third air port;

a pushing element mounted in the first chamber and having a driven end protruding out of the first casing;

a swing rod pivotally disposed outside the first casing and having

a first end facing the driven end of the pushing element; and

a second end;

a connecting rod having two ends, and one of the ends of the connecting rod pivotally connected to the second end of the swing rod;

a rotation restricting element pivotally disposed outside the first casing, and having

a first end pivotally connected to the other end of the connecting rod;

a second end; and

at least one limit portion formed on the second end of the rotation restricting element;

at least one restoring spring mounted on the at least one limit portion of the rotation restricting element;

a first micro switch disposed outside the first casing; the first micro switch electrically connected to the low-pressure blower and selectively switching the low-pressure blower on or off;

rotational pressing rod rotatably disposed outside the first casing and having

a pressing portion corresponding in position to and pressing against the first micro switch; and

a positioning portion operating in coordination with the at least one limit portion, and the limit portion restricting rotation of the rotational pressing rod; and

a first turning button mounted on the housing via a torsion spring and disposed outside the housing, and the first turning button selectively driving the rotational pressing rod to rotate causing the pressing portion to operate the first micro switch; and

a second auto-stop controller mounted in the housing and having

a second casing having an inner surface;

a switching switch electrically connected to the high-pressure blower and selectively switching the high-pressure blower on or off;

a second micro switch electrically connected to the high-pressure blower and selectively switching the high-pressure blower on or off;

a second air pressure sensing film mounted in the second casing, selectively triggering the second micro switch, and having

a peripheral edge attached to the inner surface of the second casing;

an outer surface facing and disposed apart from the second micro switch; and

an inner surface being opposite to the outer surface of the second air pressure sensing film;

a third chamber surrounded by the inner surface of the second air pressure sensing film and the inner surface of the second casing, and communicating with the third air port; and

an adjusting control mechanism selectively triggering the switching switch, and driving the second micro switch to move toward or away from the second air pressure sensing film, and the adjusting control mechanism having

a bolt rotatably mounted outside the second casing and having a triggering protrusion, and the triggering protrusion selectively triggering the switching switch;

a nut screwed on the bolt and being rotatable to move along an axial direction of the bolt; and

a second turning button disposed outside the housing, and connected to and selectively driving the bolt to rotate;

wherein the second micro switch is securely mounted on the nut and moves along with the nut.

2. The air pump as claimed in claim 1, wherein the low-pressure blower further has

a third casing having an inlet port and an outlet port;

a dividing panel mounted in the third casing and dividing an interior of the third casing into an inlet chamber and an outlet chamber, the inlet chamber communicating with the inlet port, the outlet chamber communicating with the outlet port, and the dividing panel having a through hole;

an impeller mounted in the outlet chamber and having

an air-inlet portion corresponding in position to the through hole; and

an air-outlet portion corresponding in position to the outlet port;

a switching casing mounted between the first air port and the third casing and having an air channel selectively communicating with the inlet port or the outlet port;

a motor driving the impeller to rotate; and

an air control mechanism driving the selective communication of the switching casing;

wherein the second chamber of the first casing communicates with the air channel of the switching casing.

3. The air pump as claimed in claim 2, wherein the switching casing further has a pressing protrusion selectively opening the first one-way valve;

when the pressing protrusion of the switching casing presses against the first one-way valve, the first one-way valve is open and the air channel communicates with the inlet port; and

when the pressing protrusion of the switching casing departs from the first one-way valve, the first one-way valve is closed and the air channel communicates with the outlet port.

4. The air pump as claimed in claim 2, wherein

the air control mechanism is a screw and is rotatably mounted on the third casing, and the air control mechanism has

a distal end;

a peripheral surface;

multiple first gear teeth arranged around the distal end of the air control mechanism; and

a spiral rib fanned on the peripheral surface of the air control mechanism;

the rotational pressing rod further has multiple second gear teeth engaged with the first gear teeth of the air control mechanism; and

the switching casing further has an engaging portion engaged with the spiral rib of the air control mechanism.

5. The air pump as claimed in claim 4, wherein

a support bracket is mounted in the housing;

the first casing, the swing rod, and the rotation restricting element are assembled on the support bracket; and

two opposite ends of each of the at least one restoring spring respectively abut the support bracket and the rotation restricting element.

6. The air pump as claimed in claim 1, wherein a one-way valve blade is mounted to an inlet of the second chamber.

7. The air pump as claimed in claim 1, wherein the high-pressure blower further has

a fourth casing;

an electromagnetic assembly mounted in the fourth casing; and

two open-close mechanisms mounted in the fourth casing, the open-close mechanisms connected to the electromagnetic assembly and driven to open or to close relative to each other by the electromagnetic assembly;

wherein when the open-close mechanisms are open relative to each other, an air chamber is formed between the open-close mechanisms and communicates with the fifth air port.

8. The air pump as claimed in claim 1, wherein

the second casing further has two guiding portions, and each of the guiding portions has a guiding slot;

the nut has a positioning panel, and the positioning panel has two opposite side edges respectively engaging in the guiding slots of the guiding portions to slide along the guiding slots; and

the second micro switch is securely mounted on the positioning panel.

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